Hvordan forebygge noget, som man ikke ved vil ske?

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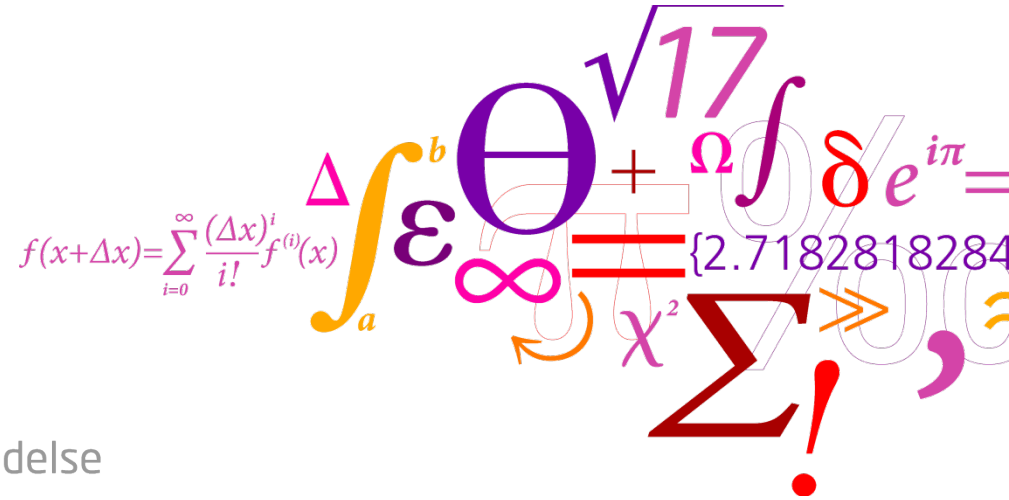
Hvordan forebygge noget, som man ikke ved vil ske?

Den 18. Nordiske forskningskonference om sikkerhed

Hurdalsjøen Hotel og Konferensesenter

8. – 10. Juni 2009

Norge



DTU Management

Institut for Planlægning, Innovation og Ledelse

Problem

- It is first after the accident has happen it is easy to see what should have been done
- Before the accident happen it is most difficult
- The hazards and the risk situations differ from time to time
- In general the hazards and the risk situations are handled
- Most often nothing happens

The paradox in the risks for accident

- The same type of accidents do happened again and again for so many people with out anybody doing anything. Why not?
- The information from the accident events is not or seldom collected, analysed and described. This results in that the important stories are not being told.
- An accident is rather seldom at the enterprise level especially at SME´s. The knowledge in the enterprises about risk and risky situations is for this reason very low.

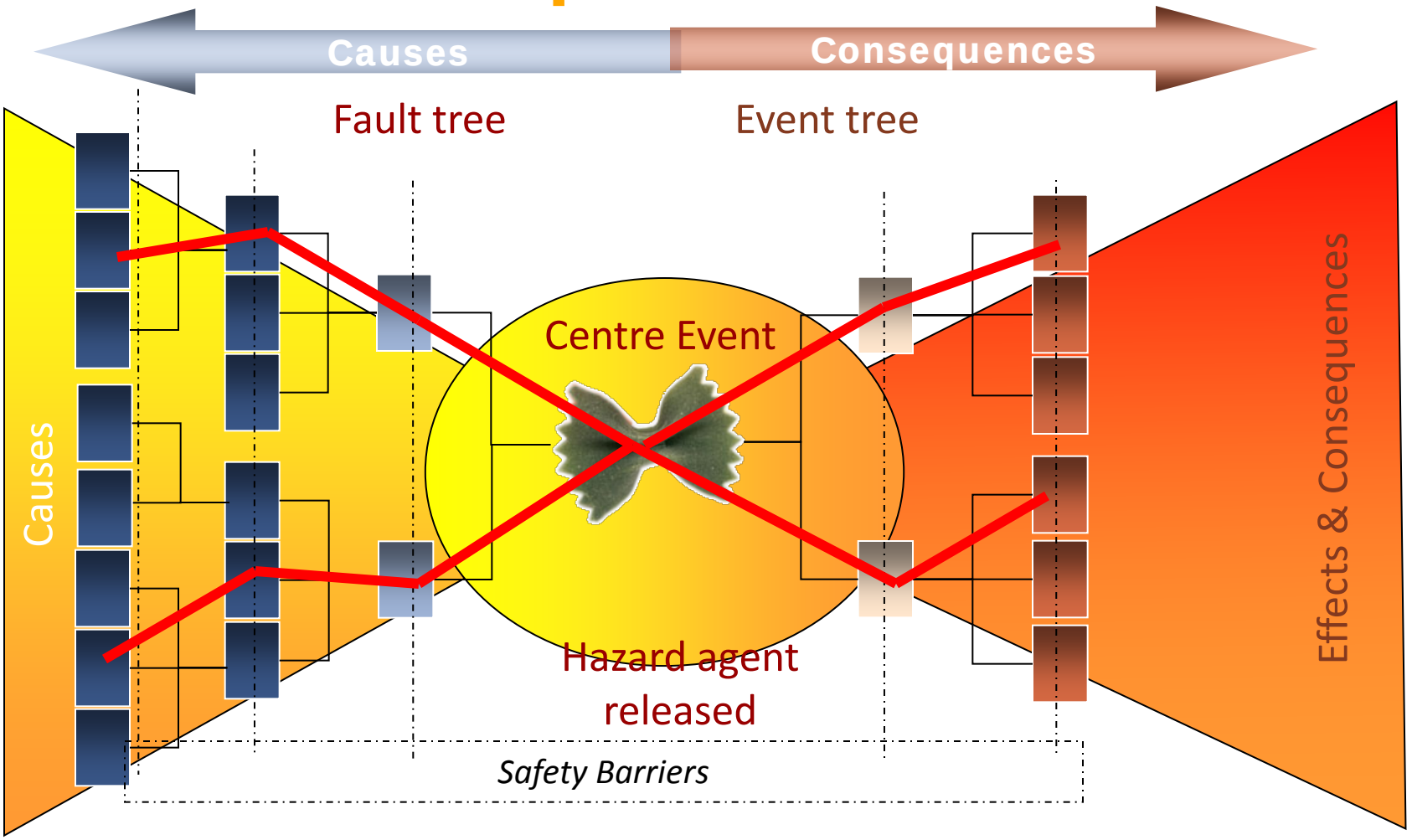
The Ministry of Social Affairs and Employment, Joy Oh

2002 The WORM project , Workinggroup for Occupational Risk Model

2006 RAM, The Risk Assesment Model

2008 ORCA, the Occupational Risk Calulation for Accidents

Bowtie concept



Linda Bellamy 2008

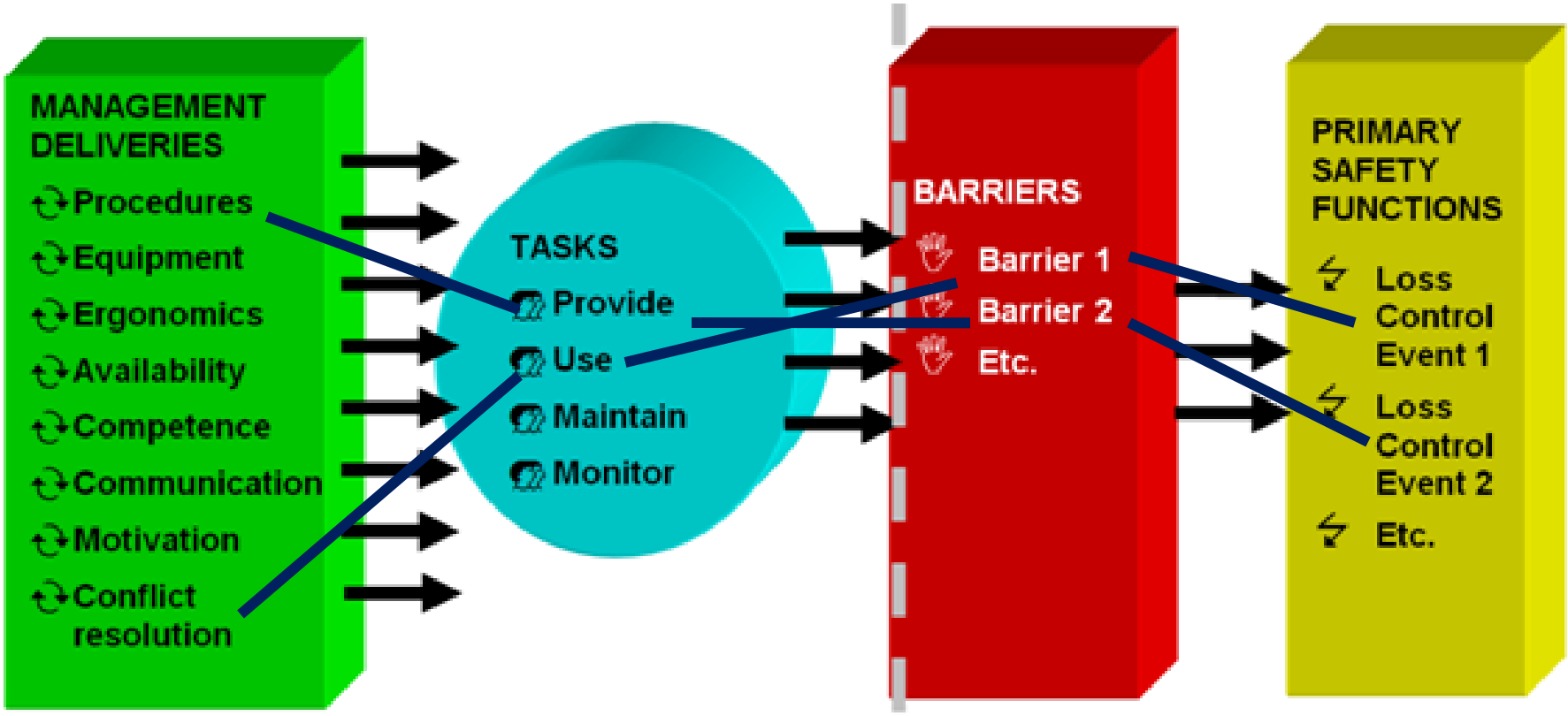
What is a barrier

Some definitions of barrier are:

- Anything that blocks a way or separates, such as a gate
- Anything that prevents progress
- Anything that separates or hinders union
- A structure or object that impedes free movement
- Any condition that makes it difficult to make progress or to achieve an objective
- A physical block or impediment to movement or migration
- A structure that bars passage, prevents access
- A fence, wall or otherwise designated boundary
- An obstacle or impediment
- A boundary or limit

Linda Bellamy, 2009

Management-Technical Interface

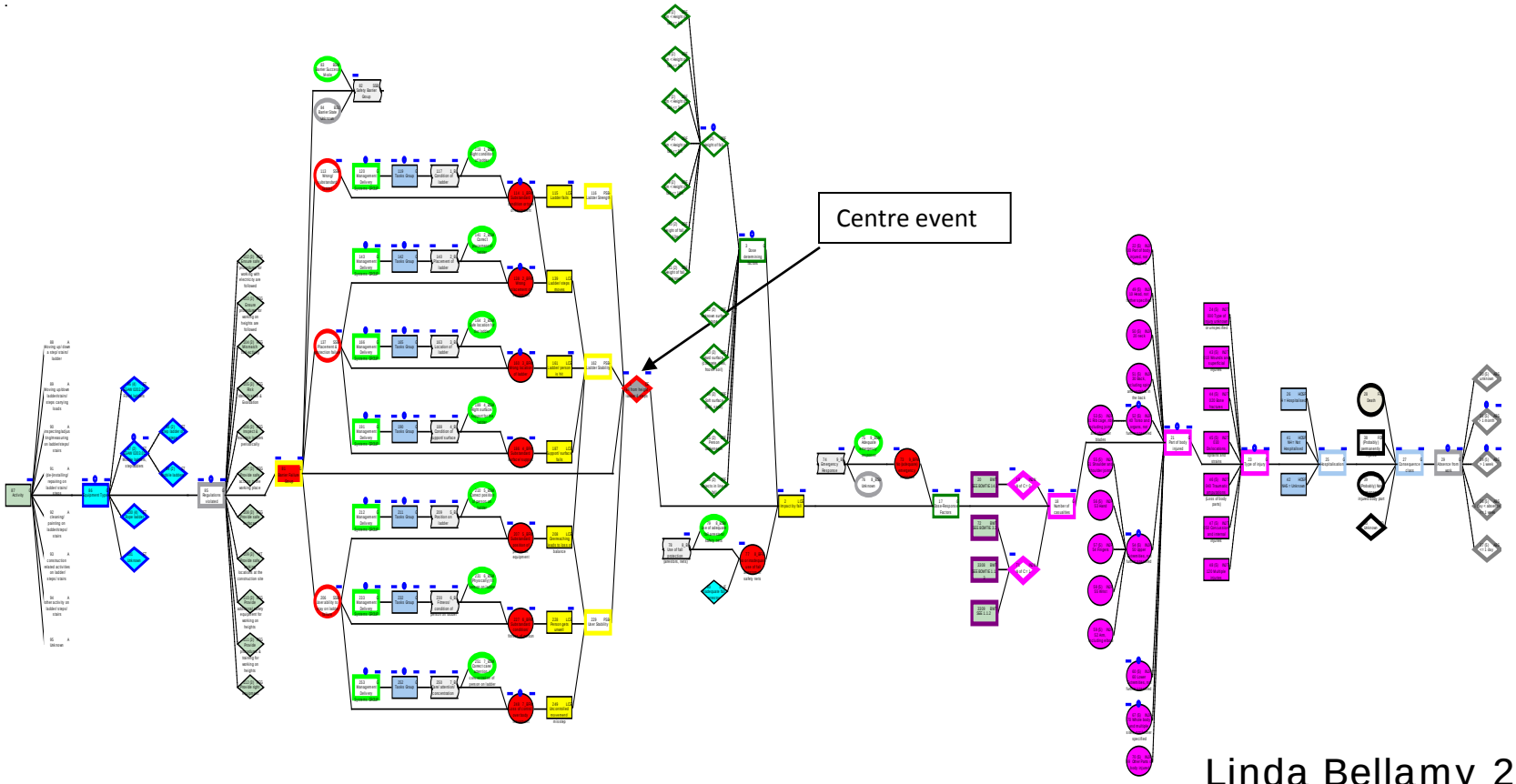


Management **Technical**

Linda Bellamy 2008

Event Structure in Storybuilder

- Made from building rules
- Analyst has freedom within the rules



Linda Bellamy 2008

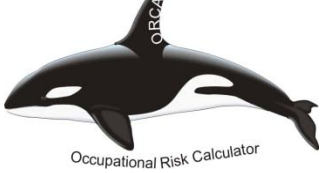
Some statistics

- 36 storybuilds
- 9142 scenarios
- 9459 victims
- ~415 safety barriers identified
- 16,314 identified and 8250 unknown barrier failures
- 16,007 identified management delivery system failures

Linda Bellamy 2008

ORCA Quantification

Linda Bellamy 2008



Storybuilder Accident Data (36 storybuilds): Numerator Data

ORCA: Logical model (64 bowties)

Probability Influencing Entities (PIEs): **PIE Questions**

Define activity bowtie relations: Danish Data

Centre Event Mission Data requirements

Develop Measures, Effectiveness and Costs Database

Exposure Surveys: **Denominator Data**

Quantification: **Probabilities per unit of exposure**

ORCA software

Input actual exposure to bowties (job, project etc.)

Select activities and bowties for job, branch, project etc

Actual workplace PIEs (or Dutch National Average default)

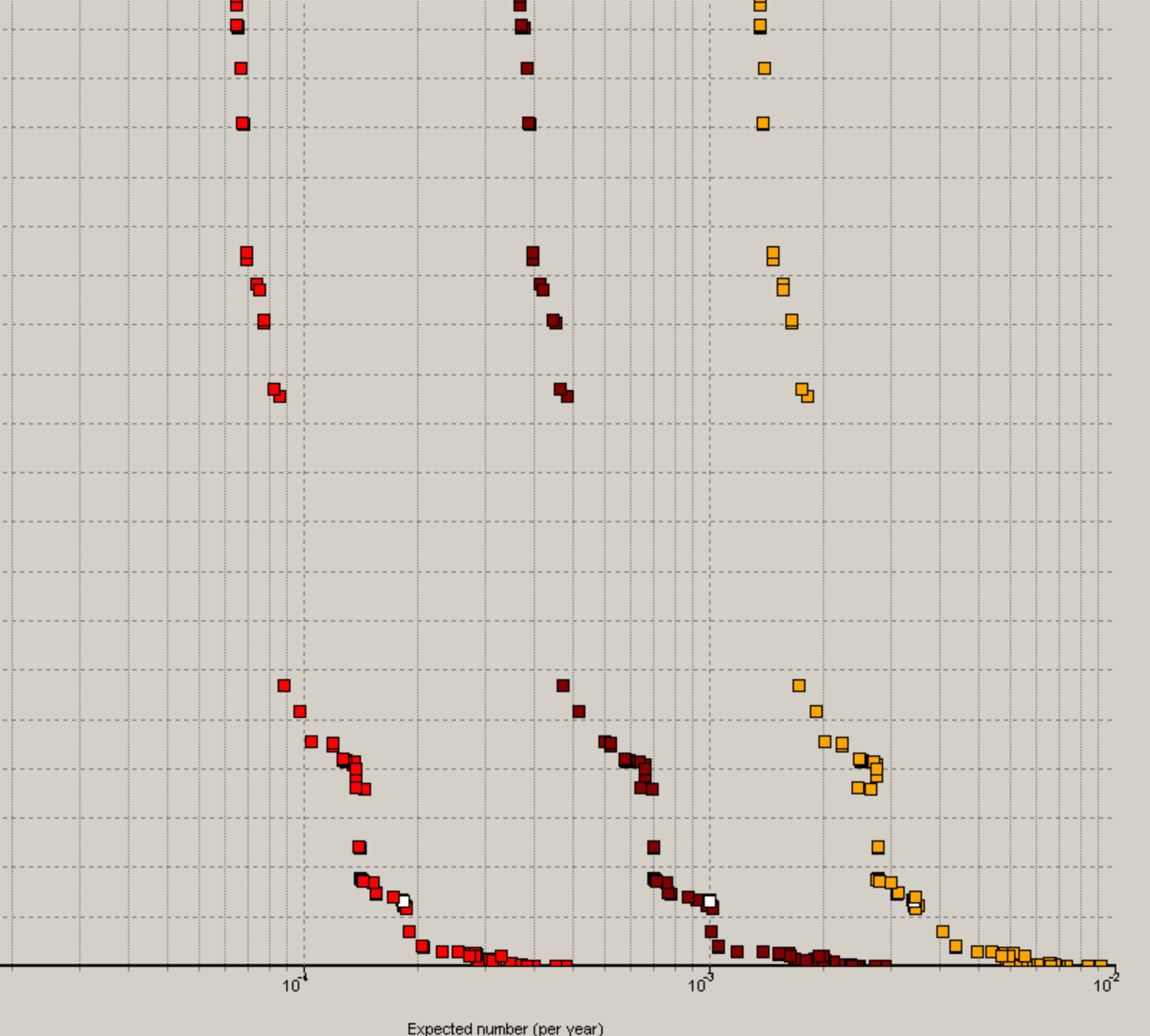
Accident Risks per year

Select Measures

Costs of measures

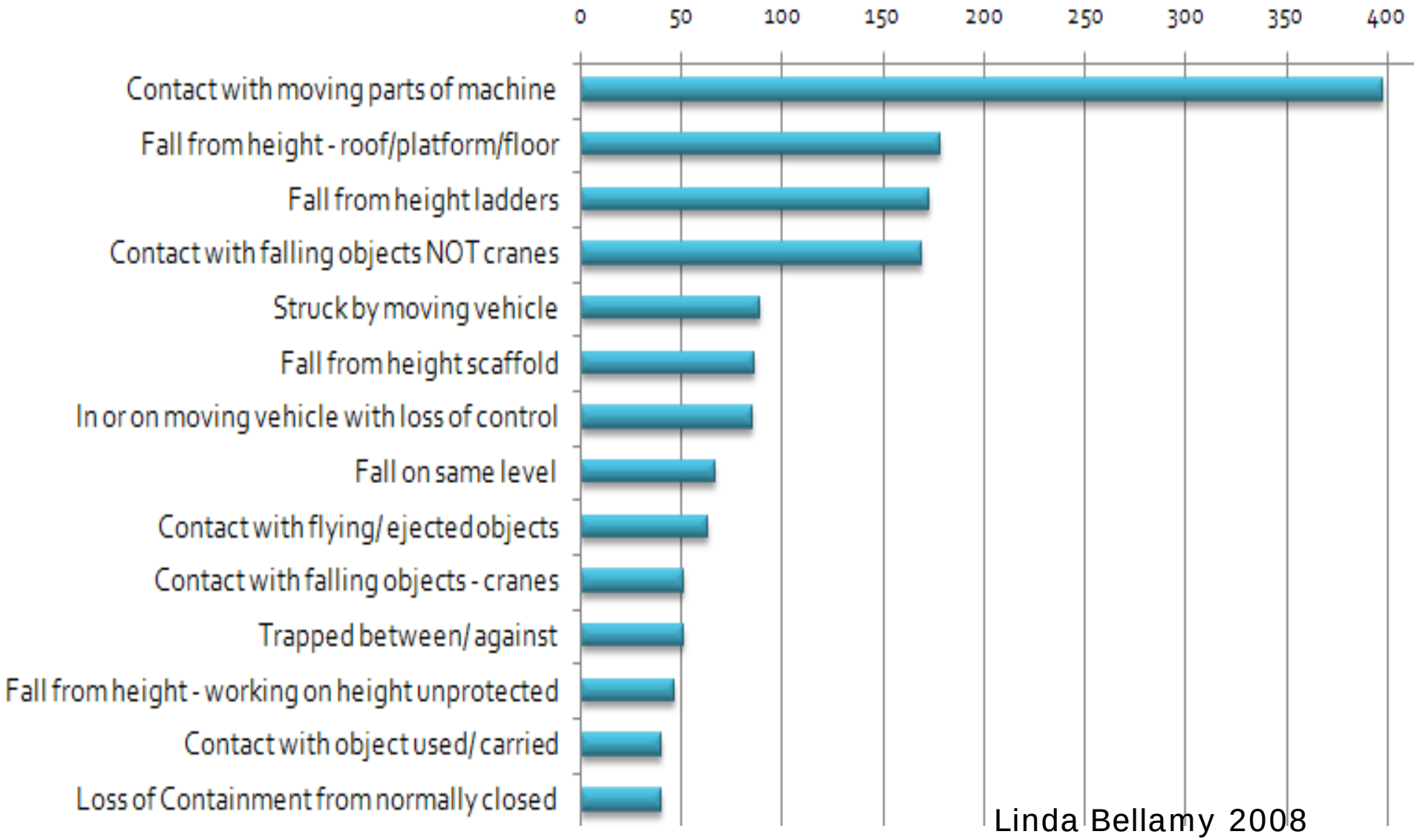
Optimiser

Optimal risk reduction for given cost



- [ ] Load rack.
- [ ] Monitor safe work
- [ ] Mark dangerous a
- [ ] Net to protect aga
- [ ] Foundations.
- [ ] Lighting.
- [ ] Raised wall.
- [x] General safety int
- [ ] Distinct work cloth
- [ ] Periodic health ch
- [ ] Periodic maintena
- [ ] Personal protectiv
- [ ] Positioning machi
- [ ] Practical training.
- [ ] Anti-slip treads.
- [x] Procedure: Manua
- [x] Procedure: Contro
- [x] Procedure: Stacki
- [x] Guardrails.
- [x] Set up area to pre
- [x] Driver training.
- [x] Clean and tidy wo
- [x] Stable surface.
- [x] Anti-slip feet.
- [x] Extend (outrigger)
- [x] Safety net.
- [x] Anchor point.
- [x] Quick and profess
- [x] Street lighting
- [x] Cordon-off workin
- [x] Procedure: Using
- [x] Ladders of the co
- [x] Instructions for sc
- [ ] Qualified personn
- [x] Instructions for ar
- [x] Good, sturdy floor
- [x] Suitability of addit
- [x] Do not place a lac
- [x] Fixed Ladder
- [x] Cordoning and sig

SERIOUS Accidents per year top 10- NL



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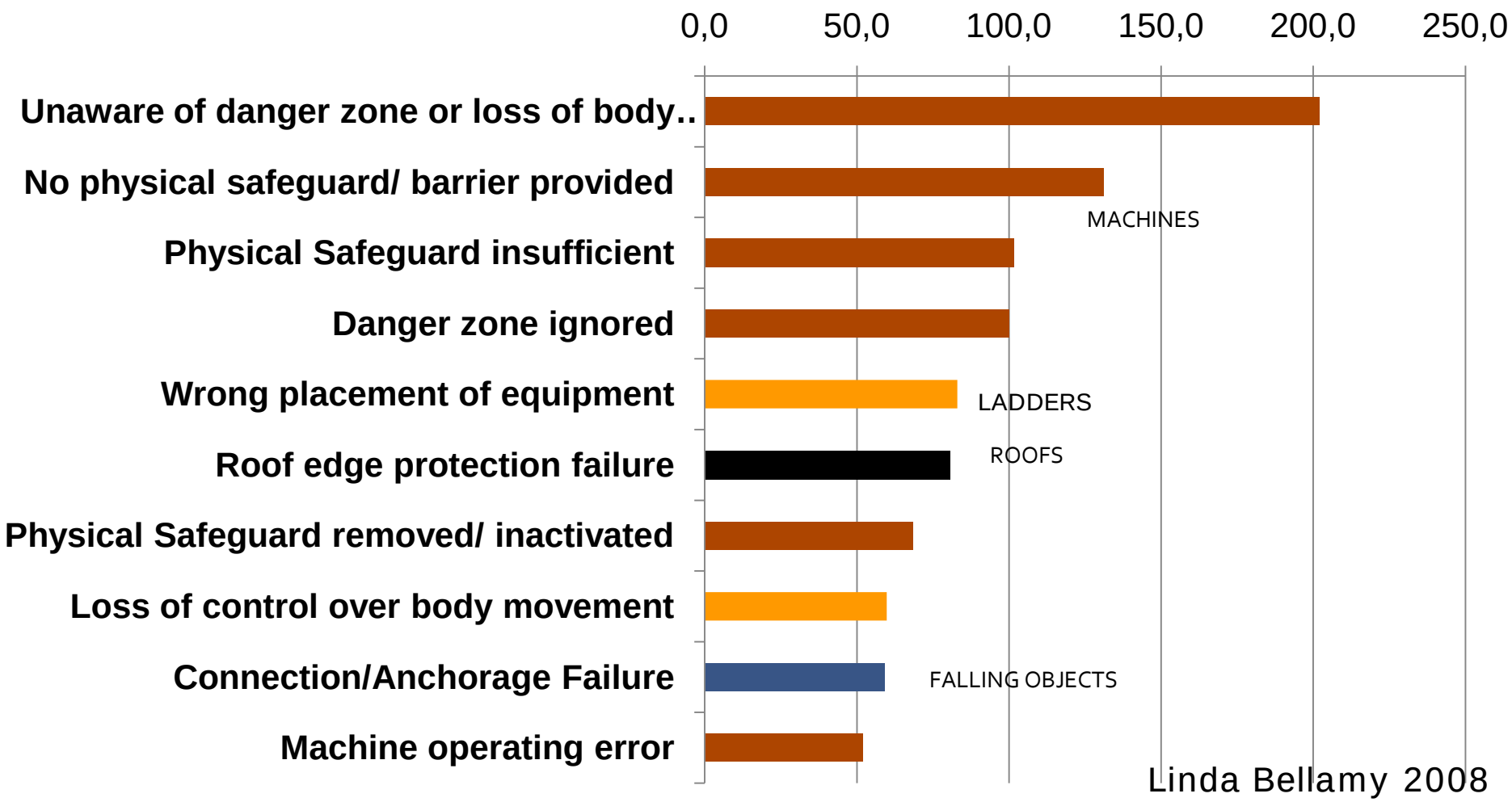
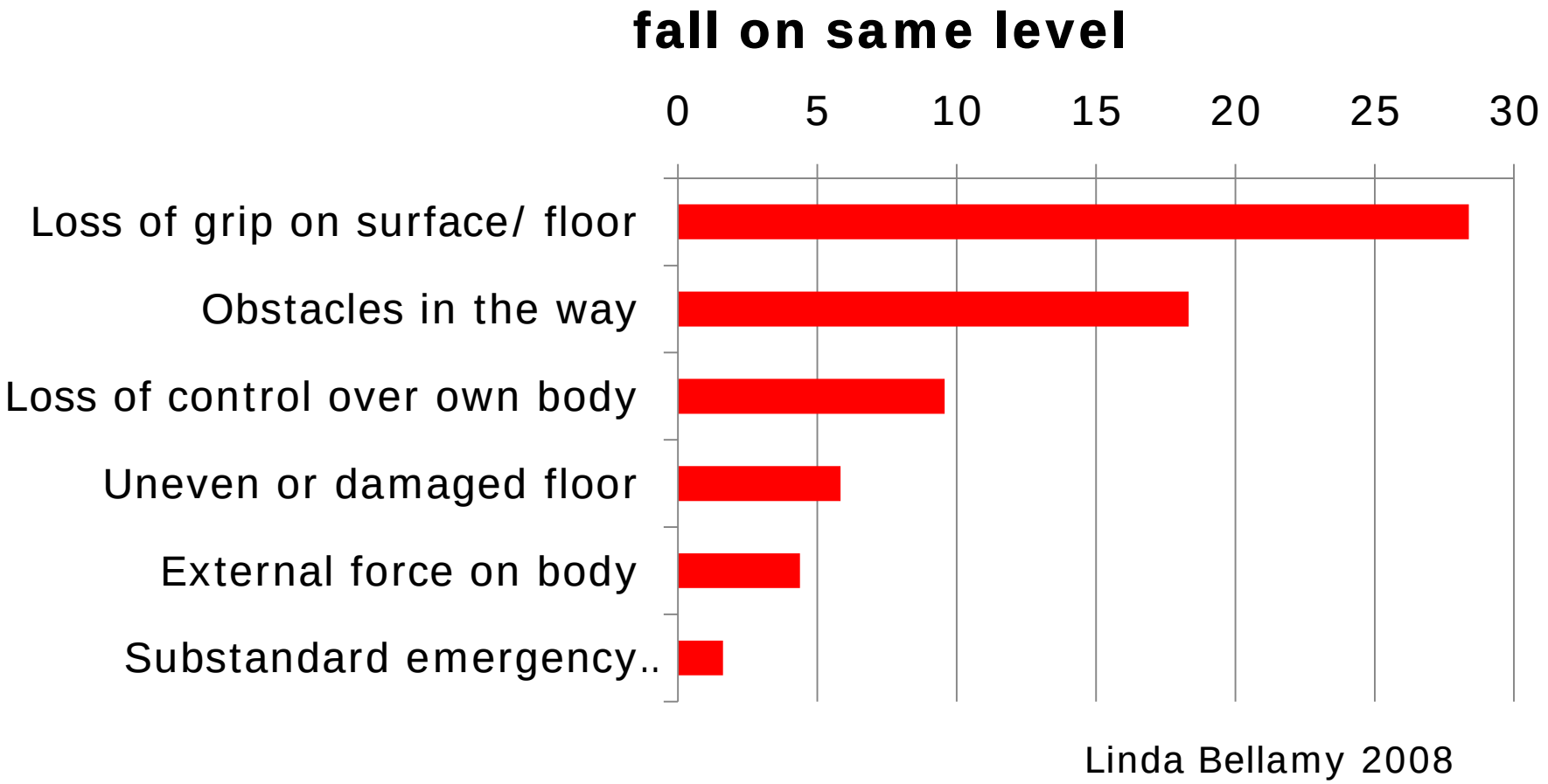
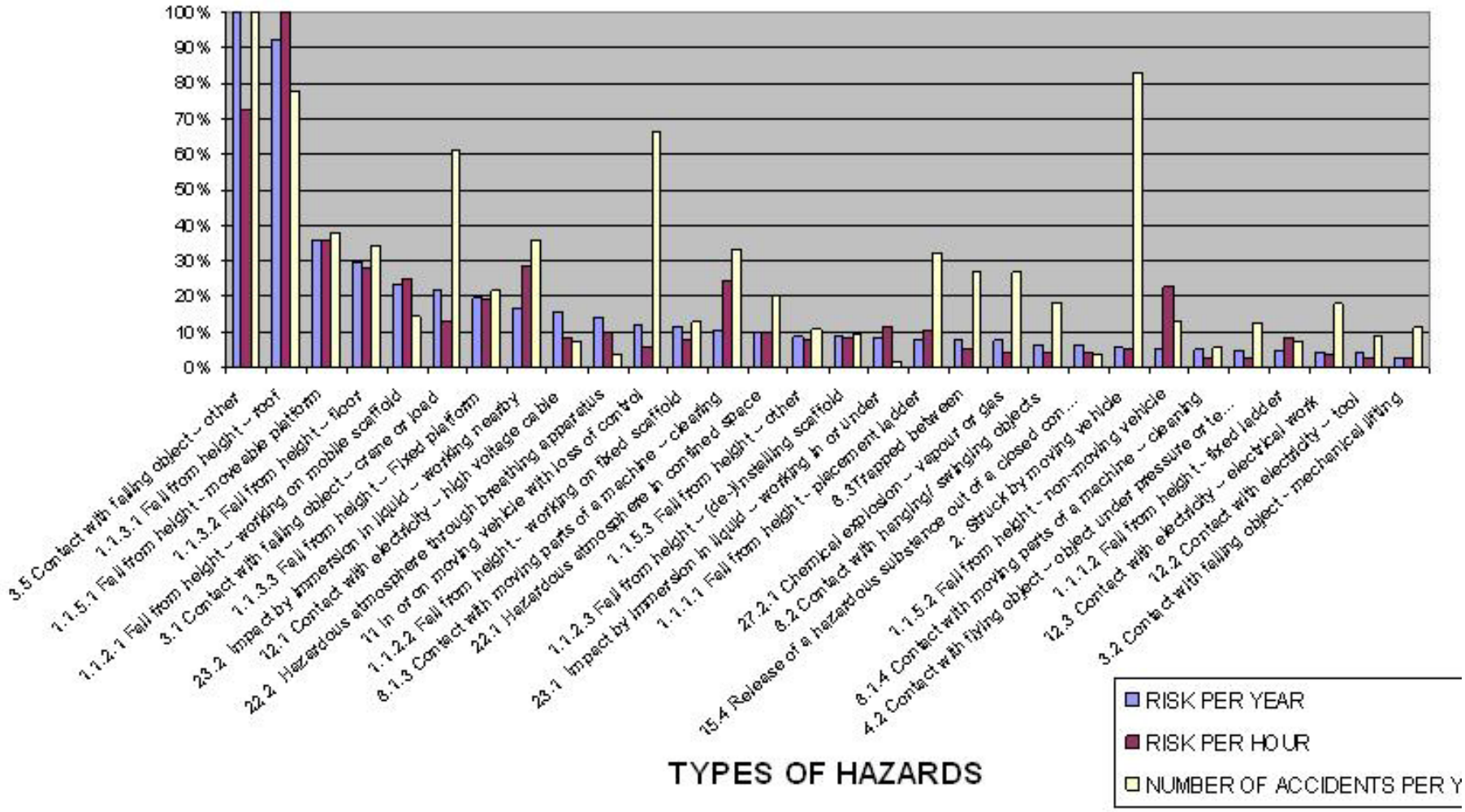
Barrier failure top 10 (accidents per year)



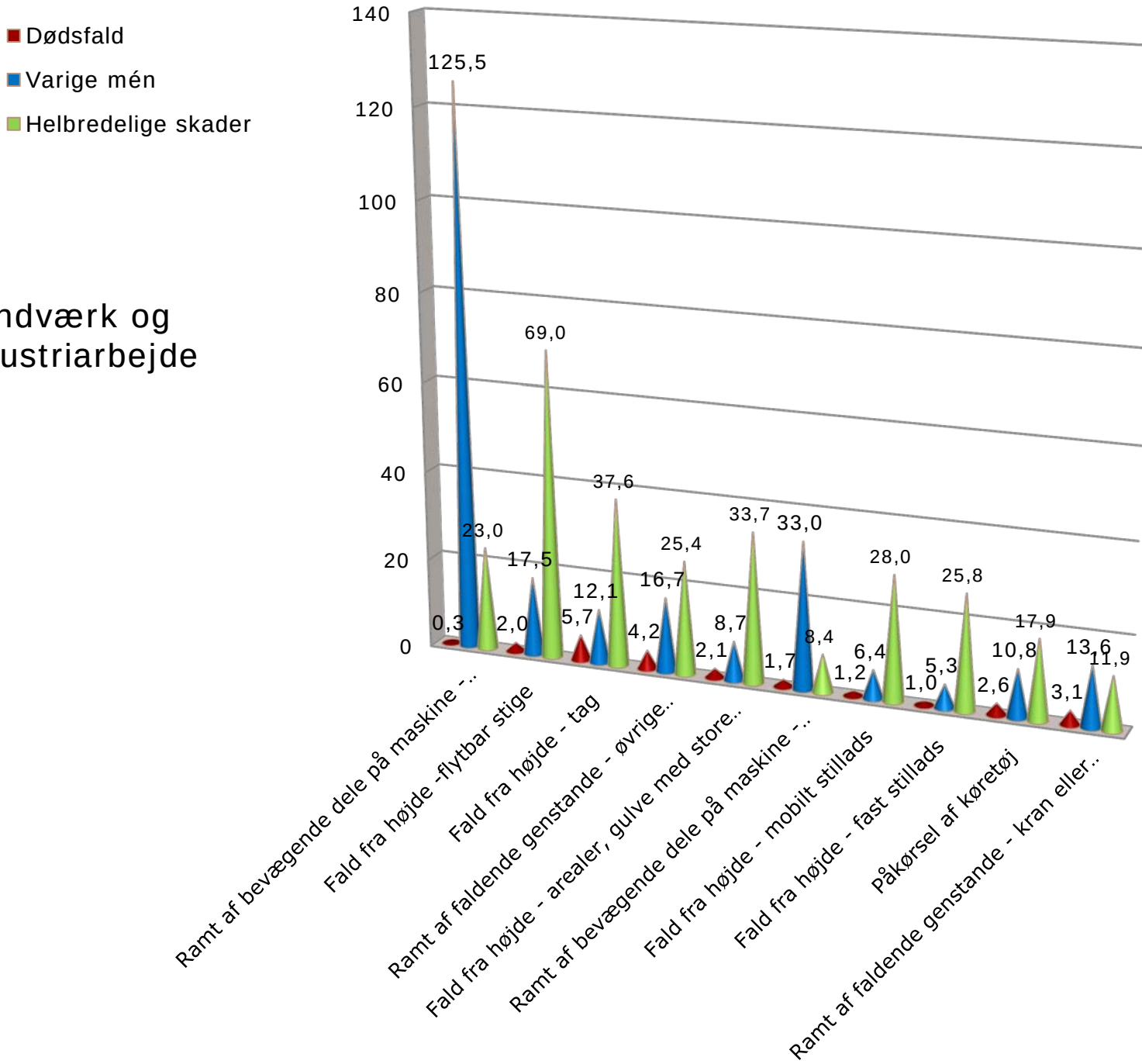
Fall on same level barrier failures (accidents per year)



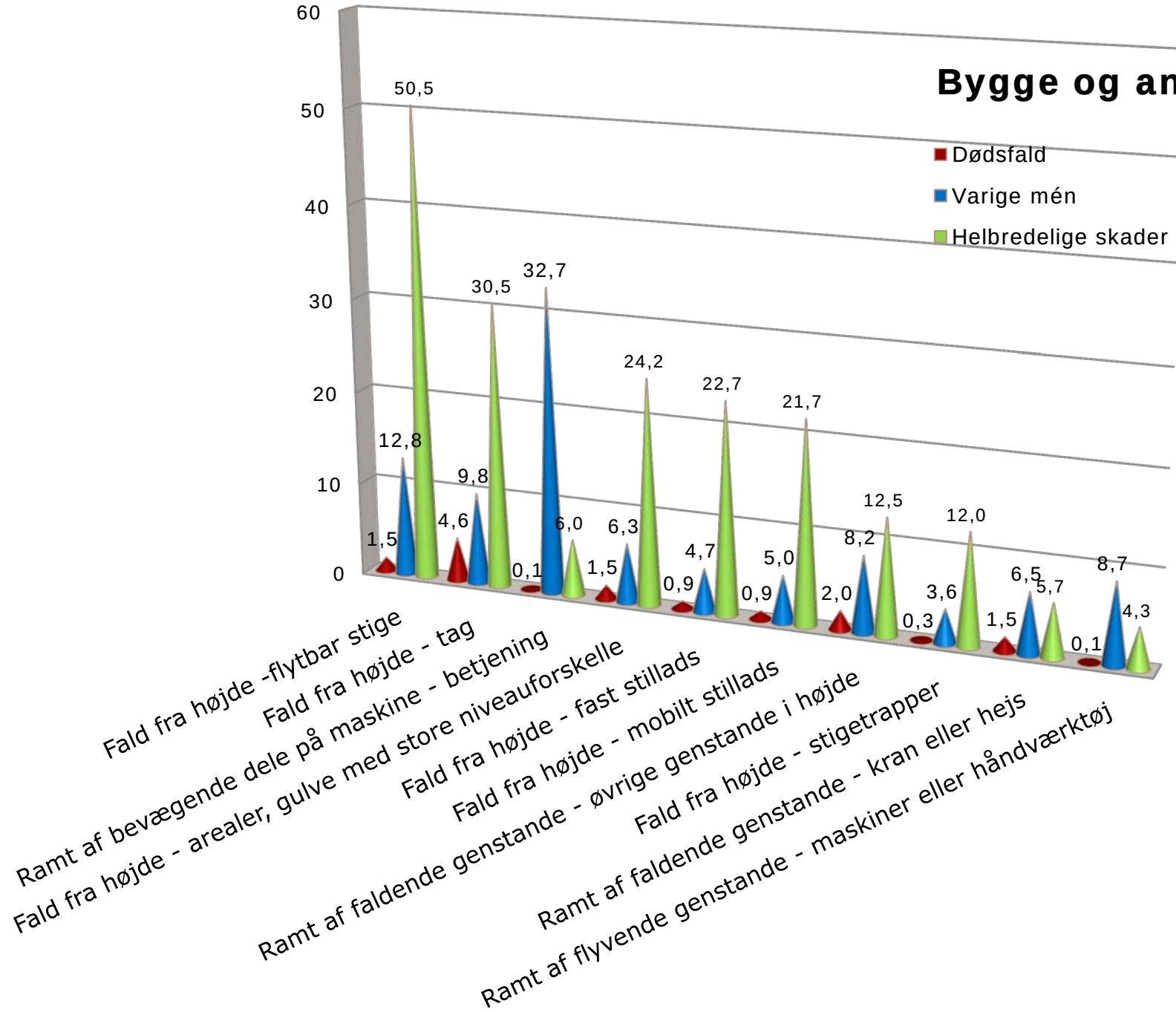
FATALITY RISK RANKING



Håndværk og industriarbejde



Bygge og anlæg

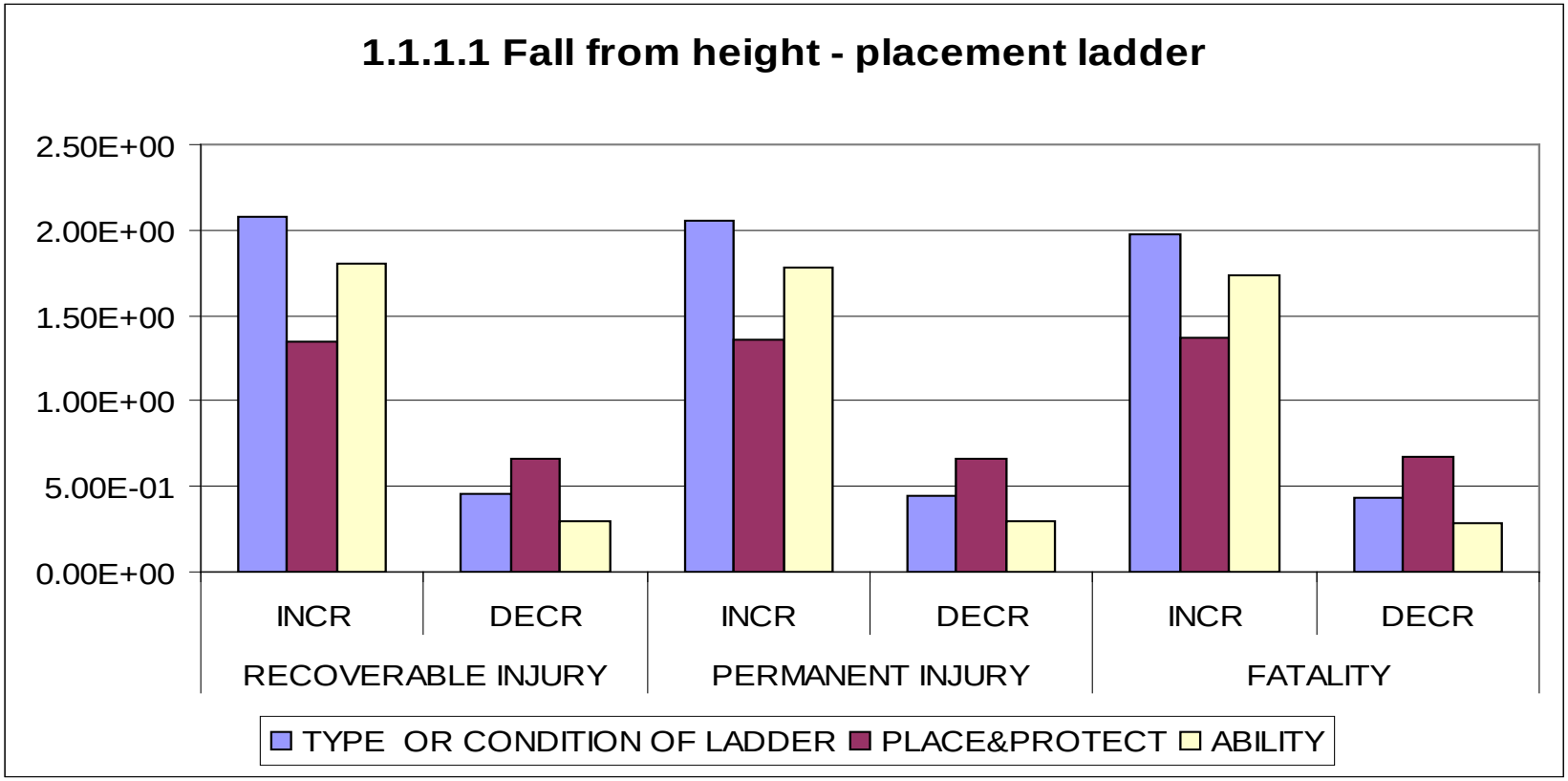


SENSITIVITY ANALYSIS

- RISK REDUCTION: Relative Decrease of Risk if barrier (or PIE) achieves its perfect state with probability equal to 1
  REDUCTION INDEX = $(R_{DNA} - R(_{Barrier\ perfect}))/R_{DNA}$
- RISK INCREASE: Relative Increase of Risk if barrier (or PIE) achieves its failed state with probability equal to 1 INCREASE INDEX = $(R(_{Barrier\ failed}) - R_{DNA})/R_{DNA}$

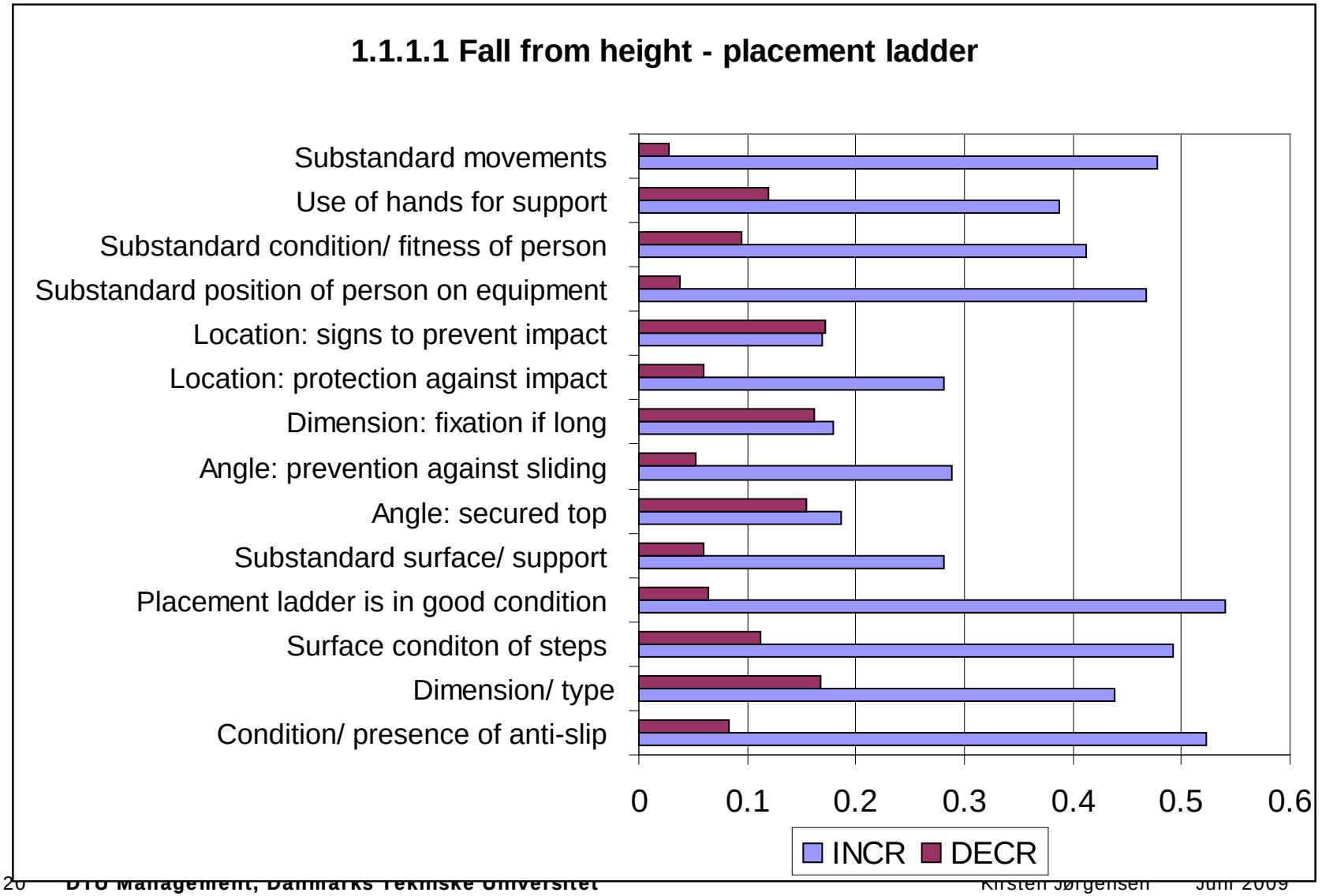
Ioannis A. Papazoglou 2008

RISK INCREASE AND DECREASE FOR VARIOUS SUPPORT BARRIERS



Ioannis A. Papazoglou 2008

RISK FATALITY INCREASE AND DECREASE FOR VARIOUS PIEs



DAN- WORM

A smaller Danish project

Kirsten Jørgensen

Nijs J. Duijm

Hanne Troen

The purpose was to make the Dutch results available in Danish and try to simplify the model to be used by SME´s

The 4 main risk focus

- Look for the risk of falling from where you are walking and where you have your feet.

- Look for the risks from your surroundings, the risk for being hit by or hit against something, being hit by collapsing or falling objects, flying objects or similar.

- Look for the risks from what you are working with and use your hands for. Risks like sharp surfaces, sticking, squeezing situations, moving tools, chemicals etc.
-
- Look for the special and very specific risks related to fire, explosion, drowning, poisoning etc.

A. The activities / hazards concerning walking where there is a risk of falling

1. Working on height / falls

- Placement ladder
- Fixed ladder
- Step ladder or steps
- Rope ladder
- Mobile scaffold
- Fixed scaffold
- (De)-installing scaffold
- Roof
- Floor with different levels
- Fixed platform
- Mobile platform
- Non-moving vehicle

2. Working on same level / fall

- Working near hole in ground
- Walking on floor,
- Walking on stairs
- Walking and overloading

B. The activities / hazards concerning your surroundings

3. Working where objects can fall down

- Cranes and loads
- Mechanical lifting
- Loadings on vehicle
- Manual handling
- Other ex stored objects

4. Working where objects can be flying around you

Flying objects from machine or hand tool

Flying objects under tension or pressure

7. Working with people or animals

- Aggressive human being
- Aggressive animals

5. Working where you can be hit against, hit by or hit between objects

- Struck by moving vehicle
- Working in open air with blowing wind
- Passing round, rolling or sliding objects
- Passing others working with hand tools
- Passing others who are handling objects
- Passing nearby hanging or swinging objects
- Risk of being trapped between or against objects
- Risk of moving into objects

6. Passing or working near-by bulk mass that could skid, collapse

- Passing bulk mass

The activities / hazards concerning what you are working with

8. Technical equipment
- Handheld tolls
- Operating machines
- Maintaining machines
- Clearing machines
- Cleaning machines

9. Vehicle
- In or on moving vehicle

10. Electricity
- Risk ofr electrocution by tools
- Electric work

11. High or low temperature / heat or cold
- Cold or warm objects surfaces
- Hot work

12. Chemicals
- Working near open containments
- Working near closed containments
- Adding, removing or opening closed containments
- Transport of closed containments
- Closing closed containments

13. Lifts and loads
- Handling heavy objects

The activities / hazards concerning very specific and infrequent high risk

14. Risks of high voltage

- Working with high voltage

15. Risks of fire

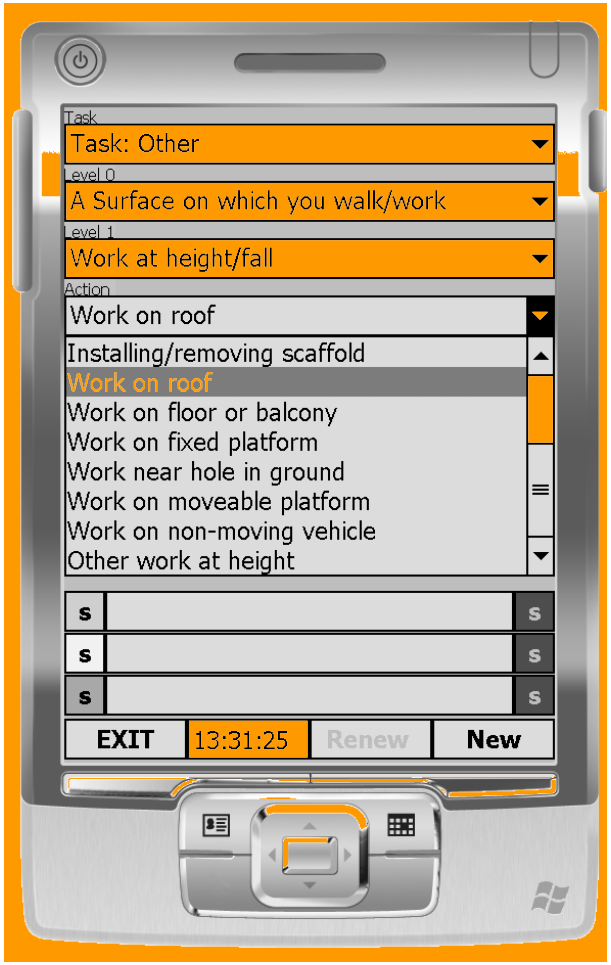
- Working close to or with open fire
- Fire Fighting

16. Oxygen problems incl. Water, lack of oxygen and drowning

- Working in confined space with hazardous atmosphere
- Working with breathing apparatus
- Working in, on or under water
- Working close to water

17. Risks of explosion

- Nearby or working with explosive equipment, objects under pressure
- Nearby or working with explosive vapor or gas
- Nearby or working in explosive dust
- Nearby or working with explosives
- Nearby or working with chemical - including exothermic - reaction


Task
Task: Other
Level 0
A Surface on which you walk/work
Level 1
Work at height/fall
Action
Work on roof
Installing/removing scaffold
Work on roof
Work on floor or balcony
Work on fixed platform
Work near hole in ground
Work on moveable platform
Work on non-moving vehicle
Other work at height
S
S
S
S
S
S
EXIT
13:31:25
Renew
New


Task
Task: Other
Level 0
A Surface on which you walk/work
Level 1
Work at height/fall
Action
Work on roof
Action Start Time
13:35:45
SSB
Capacity to keep balance
Pie
Self-induced external force by equipm
Self-induced external force by equipme
Move backwards
Health and fitness
Hands are free
Stretch over side or edge protection
Slippery surface, ice, filth, algea
Working outside edge protection
Strong wind

10 good advises to the employer

1. *Cleaning of tools, machines, vehicles, workplaces*
2. *Hoisting of materials*
3. *Placement of electrical wire*
4. *Placement of handheld tools when not used, in storage or under transport*
5. *Maintenance of tools and machines*
6. *Safety equipment for limiting exposure to dust*
7. *Safety gardening on machines*
8. *Working with windows or glass materials*
9. *The availability of personal safety equipment*
10. *The use of mobile telephones during transport*

10 good advises to the employee

1. *Safety at scaffoldings: check the railing, the floor, the cleaning, the distance between the scaffolding and the house, the manhole and evaluate the risk of falling in relation to your own well-being.*
2. *Safety at ladders: check the maintenance, the stability, the strength, the length, the firmness of the ladder's footing and evaluate the risk of falling in relation to your own well-being.*
3. *Safety when working on a roof or at heights: check the railings, the floor, fall resistance, the surface strength and evaluate the risk of falling in relation to your own well-being.*
4. *Safety at tools and machines: check the safety guards, maintenance, the placement of materials, and the placement of electrical wire.*
5. *Personal safety protection: evaluate the needs and the availabilities.*

10 good advises to the employee

6. *Safety in manual handling: check for heavy lifting, the need for hoisting equipment, the right lifting technique, the use of equipment such as a platform or small stepladder to ensure a good working position,*
7. *Safety wherever you are walking: check the cleaning, the maintenance of the main road, the placement of materials, waste, wires, tools etc.*
8. *Safety in handling waste and waste removal: check the need for personal safety equipment.*
9. *Safety in transport both at the site and in the traffic: check the traffic behavior, the maintenance and cleaning of the vehicle.*
10. *Be conscious of acute risks in the working situation such as:*

    Sharp equipment, risks of being crushed or jammed, risks of being hit against or being hit by something, fire risks, chemicals risks, dust risks, explosion risks, risks of materials collapse or fall, risks of slipping or irregular surfaces, risks of falls in general, risks from other road users.

What we do know

- WE know we have to motivate the employers to take management responsibilities
- WE know that Safety and barriers has to be integrated in daily routine and dialog
- WE know that a proactive safety approach is the road for avoiding accidents

- WE need to change the prevention approach from looking of accident events and causes towards safety barriers and risk awareness
- WE need to distinguish between the what is possible for the employer to implement and control and what the supervisor and employee must do by them self along the working day
- WE know that accidents are rather seldom in SME´s and because of this the risk awareness and motivation for preventive activities low
- WE know that information about risks is needed, but does the employee and employers know that

Our curiosity is:

1. Can this kind of information supply enterprises, employers, employees… with new knowledge about their own risk situation and
2. Will they use it and
3. Will it or can it result in a decline in accidents


Thank you for your attention